CALIFORNIA
STATEWIDE ITS
Architecture & System Plan

INSIDE THE
CALIFORNIA ITS ARCHITECTURE

DRAFT   NOVEMBER 2004

CONTACT INFORMATION

For more information about the California ITS Architecture
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www.kimley-horn.com/CAArchitecture

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"The Statewide ITS Architecture and System Plan has already shown its value by bringing together regional agencies around the state to discuss the use of advanced technologies and further our joint goals of improving the safety, mobility, and efficiency of our transportation network. Considering advanced technology options not only serves to strengthen the working relationship among state transportation agencies, it does so in support of the Department's mission and goals. We are pleased with the outcome of the work efforts and wish to thank stakeholders for their persistence and involvement. We are looking forward to seeing this plan lead to implementations."

–Joan Sollenberger,
Caltrans Division of Transportation Planning

Introduction

Janice Moore must get from her office in Palo Alto to Napa Valley to handle an emergency in her restaurant. She needs to get there as quickly as possible. So she calls out "Traffic Information - Palo Alto to Napa Valley." Her office computer recognizes her voice and in a matter of seconds, a real-time map pops up on her computer screen. A flashing line indicates that the quickest route at this time is across the Dumbarton Bridge, then north on I-880. No red dots on the map signifies that there are no major incidents between Palo Alto and Napa Valley right now. A flashing 1:40 indicates the expected travel time. The computer also announces the information "As of 1:15 PM, the quickest route is Dumbarton to 880. No incidents at this time. Approximate travel time 1 hour 40 minutes".

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Futuristic? Not really. The technology is out there to make this a reality.

As many areas of the country, including California, struggle with problems of clogged roadways, delayed goods movement, unconnected transit systems, and limited funds, leaders are continually searching for new cost effective alternatives to improve the transportation network. In California, our challenges are increased further by the geographic expanse and diversity of the state, the increasing population, the build-out of our metropolitan areas, limited access in our rural regions, increasing concerns about safety and security, and, lately, economic uncertainties that have further challenged us to find adequate solutions that can keep pace with demands. Yes, we can build new roads, but that can be both costly and disruptive.

So other than building more roads, what is the solution? Technology.

Technology has improved our ability to instantly communicate with each other on a daily basis through the use of cell phones, PDAs, e-mail, and voice mail. So why not use advanced information technology to instantly communicate roadway conditions, process truck credentials and fees, facilitate faster accident response for police and ambulances, and coordinate transit services to make traveling through California easier, safer, and more efficient? This information technology is known as intelligent transportation systems (ITS) and by using ITS, we can improve regional mobility.

ITS can improve our transportation network by:

▷ improving safety and productivity/throughput of our freeways and highways;

▷ increasing the reliability and accessibility of our transit systems;

▷ improving the efficiency of the transport and delivery of our goods;

▷ providing information to travelers that paints a picture of transportation options available at that moment in time; and

▷ by connecting transportation modes, routes, and options across the state.

What is ITS?

ITS Defined

ITS is concerned with the developmnet of advanced technology systems and new processes to improve the safety and efficiency of transportation systems. So what does that mean?

ITS employs information-based, advanced technologies like sensors to detect vehicles and traffic, computer software to collect and process information, electronics for uses like message signs that can be used for Amber Alerts, and communications technologies that can connect agencies all over the state.

ITS also employs new processes like coordinated management strategies among agencies involved in managing traffic and responding to incidents, electronic processing of "paperwork" such as credentials required for trucks to drive on our roads, computer software that assist in managing traffic and increasing throughput, and connections between public agencies for efficiencies that, for example, enable drivers or truckers to go to one source to pay for certain services while the agencies sort out the payments.

ITS covers a whole range of services including traffic management, traveler information, transit management, commercial vehicle operations and emergency management, to name a few.

Benefits of ITS

The benefits of ITS applications have been well documented by the Federal Highway Administration (FHWA) over the past decade. By using before and after studies of ITS projects across the country, the FHWA has compiled numerous examples of measurable ITS benefits. Their conclusion is that these benefits can be expected from similar ITS deployments in other areas.

The greatest benefits in terms of safety, efficiency, and costs are realized when electronic systems are linked together so that different agencies can coordinate activities and share information for improved service to their customers: travelers.

These measured benefits support the idea that ITS projects can affect measurable improvements to our transportation network when deployed either in lieu of, or in conjunction with traditional roadway infrastructure projects such as roadway widening.

The ITS Plan

Effective deployment of ITS requires planning and a coordinated effort between multiple stakeholders to assure the highest potential return on investment. That is why Caltrans has embarked on a mission to develop a consensus-based Statewide ITS Architecture and System Plan for California. This plan is formulated on behalf of, and in partnership with stakeholders throughout the State. The plan brings together traffic and transportation leaders in California to develop an ITS mission, and provide outcomes and implementation strategies that will address the current and future challenges that agencies are experiencing through statewide and inter-regional planning and coordinated transportation strategies.

How Does ITS Benefit Me?

Improvements in:
- Safety
- Mobility
- Capacity/Throughput
- Customer Satisfaction
- Productivity
- Energy/Environment

As a public service, the United States Department of Transportation (USDOT) sponsors a regularly updated online ITS Benefits and Unit Costs Database at www.benefitcost.its.dot.gov, *which gives transportation professionals the information they need about benefits and costs of ITS implementations and services.*

Measurable Safety Benefits:

▷ **Accident reductions**

▷ **Fatal crash reductions**

▷ **Injury reductions**

Also measured by:

▷ **Faster response times to incidents**

▷ **Reduction on speed variations**

▷ **Reduction in traffic safety law violations**

What is the CA ITS Architecture and System Plan?

ITS Architecture

An ITS architecture is not technology specific, it is more of a way to establish a common framework to ensure that individual ITS components fit together and interact with each other to make the system work. The end goal of an architecture is to achieve effective communication among system components and between technology systems.

The Statewide Architecture Plan

A number of areas in California have already developed ITS architectures for their regions. While these architectures are useful for guiding ITS deployment within those regions, the need was recognized to address the potential for interregional coordination and to comprehensively address state-level needs.

The focus of the California ITS Architecture and System Plan builds upon the existing regional efforts. The plan identifies common transportation challenges that multiple regions are seeking to address with the same or similar solutions. The common threads among the regions will help determine where integration and coordination may add value to travelers across the state.

Extensive outreach throughout the development of the plan has assisted in developing a consensus of stakeholders impacted by the decisions. The resulting plan has achieved an ITS architecture for statewide services and provides a framework for interregional ITS planning. While the final outcomes of this architecture plan are not intended to be requirements, they are designed to enable California to share information and integrate services for a more streamlined, efficient and safer transportation network.

> **There are currently 19 regional ITS architectures in California. A statewide architecture would enable them to "talk" to each other and share information across regions.**

"Through the process of coalition building and stakeholder involvement, I have seen change occur in direction of the project and the end result is an architecture that addresses the ideas and interests of the stakeholders. The architecture manages to provide guidance for both urban and rural ITS needs in an equitable way. It is a valuable resource and important document for agencies in California to recognize and understand statewide investments and their impacts and relationships to their own regional projects."

–Frank Cechini
Federal Highway Administration

While heading towards the Gold Line rail station near his house, Gregory's PDA beeps. He finds that a "Transit Alert" has been sent to his PDA. It seems that the route he had pre-programmed for today is experiencing a major delay due to a disabled train. How did his PDA know to send this information? Using local transit agency websites, he pre-programmed his planned routes the night before. This way, he can be alerted immediately of any schedule or route changes and plan accordingly.

Vision and Anticipated Outcomes

How do we know what transportation and traffic improvements are important to the traveling public? How do we determine where the needs are? How do we implement a change? To answer these and other statewide traffic and transportation questions, public and private stakeholders from around the state came together to outline a vision for a California ITS architecture. Their challenge in creating this vision was to determine where ITS is headed in the state and also to provide the foundation for the California ITS Architecture and System Plan. Through a series of workshops and input sessions, the stakeholders developed a vision for the future of ITS in each of the following categories:

▷ Traffic Management

▷ Emergency Management

▷ Public Transportation

▷ Goods Movement

▷ Electronic Payment

▷ Traveler Information

▷ Data Archiving

▷ Vehicle Safety and Control

▷ Maintenance and Construction Management

The anticipated outcomes from this collaborative visioning session have helped define where California ITS will be in 10 years, what types of services will be in place, and how to integrate the necessary coordination of those services across the state or between regions. Those aspects of the vision that would fall to state-level agencies to deploy form the backbone of the Statewide ITS Architecture and System Plan. Additionally, recommendations are made in the plan for interregional coordination for those desired outcomes that are the responsibility of regional or local agencies to achieve. Following is a summary of the anticipated outcomes in the nine service categories, however, it is important to note that these outcomes are intended to serve as a guideline for statewide ITS implementation, not as mandatory milestones that must be achieved within the 10-year timeframe.

Traffic Management

Currently, California roads are managed by cities and Caltrans Districts through the use of technologies such as traffic signals and ramp meters. Locally, coordinated efforts among police, fire, and other emergency service providers enable the fast clearance of incidents to keep traffic moving. The future of traffic management in California will be based on closer coordination among the different agencies that are involved in arterial and freeway management and accident response to improve mobility across our state, regardless of agency boundaries. These cooperative improvements would also improve the safety and quality of life for Californians by making programs such as Amber Alert possible.

Enhancements to existing Caltrans traffic management software in some districts will provide a more uniform solution that increases the efficiency of operations and equipment maintenance, saving taxpayers money. Another high priority is to have a comprehensive network of data-collection infrastructure throughout the state that provides access to reliable and useful data for public agencies, private service providers and the general traveling public. There will also be a special focus on improving mobility on state routes serving our state's Ports. Traffic management data will be available in a variety of accessible formats (for example, visual, audio, large-print) and the projects will comply with the available national ITS Standards.

Phoenix, AZ: Signal coordination along a roadway resulted in a 6.7% reduction in crash risk, improved travel speeds, and a reduction in the average number of stops.

California: Vehicle delay was reduced by 25% along 76 corridors in California cities that implemented an advanced signal system.

Phoenix, AZ and Richmond, VA: Signal coordination at major intersections reduced fuel use, ranging from a 2% savings in Phoenix, Arizona to a 12% decline in Richmond.

Emergency Management

California is a state susceptible to multiple types of disasters requiring a public response: earthquakes, floods, fires, etc. A greater emphasis is being placed on emergency management than in the past. As we move into the future, California agencies are working toward more effective and efficient preparation for the communication and coordination of response procedures for natural and human-caused disasters and evacuations, including hazardous materials transportation routes. It is envisioned that these procedures will be developed in coordination with adjoining states' and national procedures and guidelines. Involvement by local and regional agencies would be at their interest level and discretion, but is not required by the statewide architecture and system plan.

San Antonio, TX: The LifeLink project enabled emergency room doctors to communicate with EMTs using 2-way video, audio, and data communications. It is expected that this technology will have more positive impacts in rural areas.

Phoenix, AZ: Computer-aided incident investigation equipment was purchased to reduce incident clearance times and improve the quality of accident investigations.

Public Transportation

With hundreds of transit agencies providing fixed-route, on-demand, and door-to-door services in California, there are many opportunities for technology and communications to improve service to riders. While most of the transit services are local, some provide interregional service, such as from Sacramento to the Bay area or from the Central Coast to San Diego.

Denver, CO: RTD implemented its AVL (automatic vehicle location) system to improve bus service, and succeeded in decreasing passenger late arrivals by 21%.

San Jose, CA: An outreach paratransit program installed AVL on 40 vehicles. The automated scheduling and routing system enabled shared rides to increase from 38% to 55%, allowing the fleet size to decrease from 200 to 130 vehicles.

In the future, communication of delays on major interregional transit services can help avoid stranding passengers who make common connections between regions. A multi-modal trip planner will incorporate real-time transit information, allowing public transportation users to plan trips across the state. Real-time public transportation information will be available to riders during their trips on a statewide basis on key corridors in a variety of accessible formats (for example, visual, audio, and large-print). Public transportation systems will have communication systems that are accessible by drivers and passengers that notify appropriate agencies in emergency situations.

Goods Movement

"Port container traffic and air cargo volumes are expected to triple by 2020, while overall goods movement volume is projected to jump 56 percent, between 1996 and 2016", according to the Global Gateways Development Program report developed by the State of California in 2002. The goal of ITS goods movement strategies and programs are to provide efficient and safe movement of goods through California. Currently, strategies and projects to improve mobility and safety related to commercial vehicles are in place and being expanded and enhanced.

A two-year study by the American Trucking Associations Foundation found that the commercial vehicle administrative processes (CVAP) reduced carriers' costs by an estimated 9-18% when electronic data interchange (EDI) was used.

Georgia; Kentucky; North Carolina; Tennessee: Evaluated the performance of an infrared brake screening system designed to inspect commercial vehicles for brake problems as they enter weigh stations. The percentage of commercial vehicles placed out of service because of brake problems increased by a factor of 2.5 as a result of infrared screening at these stations.

Most truck drivers and CVO inspectors surveyed during the CVISN model deployment initiative (a pilot project to evaluate the impacts of electronic screening, electronic credentialing, and safety information exchange) felt electronic screening saved them time.

The future for goods movement is based on one-stop credentialing for all commercial vehicles traveling in California to keep trucks moving and promote the efficient delivery of goods through and within the State. In the future, public agencies will be able to collect and share real-time data about goods and carriers for enhanced management of our transportation network in coordination with other agencies. Trucks will be getting traveler information that is customized to what they need, such as current speeds on specific corridors combined with alternate allowable truck routes in those areas. Overall, goods movement and traffic management technologies and strategies will work together with a special emphasis on improving mobility on state routes that provide access to ports.

Electronic Payment

Currently, a transit user in specific regions in California has the ability to use a smart card to use various transit services only within that region. In the future, these separate fare payment systems may be linked with other regions to provide a one payment system across regions or even statewide. For example, users can currently use an on-dash transponder to use any of the state's toll roads and bridges. Operating agencies of the toll facilities reconcile fares behind the scenes, and users only have to pay one bill for one account. In the future, this single account concept may extend beyond tolls to include transit fare payment and potentially other services, such as parking and goods movement credentialing.

Implementation of the E-ZPass system by the New Jersey Turnpike Authority (NJTA) reduced delays for all vehicles at toll plazas by 85%.

The cost for the Oklahoma Turnpike Authority to operate an electronic toll collection (ETC) lane is approximately 91% less than to staff and operate a traditional toll lane.

A study of ETC on the Tappan Zee Bridge in New York City showed an ETC lane could process 1,000 vehicles/hour (vph), while a manual lane could handle only 400 - 450 vph.

Traveler Information

The goal of traveler information systems is to provide the traveling public with the most up-to-date travel conditions so they can make informed decisions regarding destination routes, choices of alternate transportation, and travel time. Traveler information systems provided by public sector agencies in California will be deployed on a regional basis. The agencies that build and operate these regional traveler information systems will enable their systems to be able to link to other systems to provide the potential for a coordinated interregional system in the future. The future of traveler information systems will provide customized real-time traveler information for truckers, and the traveling public will have access to a trip planner that enables them to plan trips across the state.

The vision of the trip planner is to provide an interface to trip planners and to incorporate real-time transit information for key corridors throughout the State. To make this vision a reality, a comprehensive network of data-collection infrastructure developed through traffic management systems will be necessary.

San Francisco, CA: 45% of travelers receiving information from the Travel Advisory Telephone System changed their travel plans; 81% of travelers receiving specific route information from the TravInfo Internet site changed their travel plans; while only 25% of travelers altered their travel plans based on television or radio broadcasts.

Washington, DC: A study found that individuals using traveler information services could improve their on-time reliability while reducing the risk of running late. Individuals using traveler information improved their on-time reliability by 5 to 16% when compared to travelers not using the service.

Data Archiving

Many of the technology systems that are in place to manage traffic or collect other types of data, such as weather information can provide valuable data for secondary purposes such as transportation planning and fine-tuning of operating and response procedures. In California, the archiving of traffic and other data for such uses is currently done at a regional level. A statewide service for archiving state-level data such as that from Caltrans districts and headquarters, and potentially CHP data, is the future in California. Regions could utilize this system to archive regional and local data if they so desire. Once archived, the data would be available to users such as public agencies, private consulting firms, or the general public.

Las Vegas, NV: The software installed for the freeway management system (known as FAST) will provide the capability to receive, collect, archive, summarize, and distribute data. The cost to develop the design for the implementation of the Archived Data User Service (ADUS) for FAST was approximately $225,000 (a fraction of the $4.2M for the entire system). This cost included a needs assessment, update of functional requirements, update of the regional architecture for the Las Vegas area, and system design.

Vehicle Safety and Control

The goal of vehicle safety and control is to provide driver warning and assistance to increase safety and ease of travel. Caltrans will continue to provide leadership at the state level that includes resources and recommendations to ensure that vehicle safety and control initiatives throughout the state are capable of interfacing with federal vehicle-infrastructure related initiatives and programs.

San Antonio, TX: Reductions in incident-related delays also lead to fuel savings and related emissions reductions. A study of the TransGuide system of freeway and incident management found the system saved an average 2,600 gallons of fuel during major incidents.

Maryland: A study of the Coordinated Highways Action Response Team (CHART) found the system reduced average incident duration 57% in 2000.

San Antonio, TX: Combined incident management and freeway management systems along the Medical Center corridor reduced crashes 2.8%.

Colorado: A dynamic truck downhill speed warning system installed on I-70 decreased truck accidents 13% and reduced the use of runway ramps 24%.

Maintenance and Construction Management

In the future, Caltrans will have a real-time work zone monitoring system for use in work zones and roadway condition monitoring to detect icy bridges and other pavement conditions, both of which will be coordinated with District traffic management and traveler information systems. Automated avalanche warning systems on state highways will enhance safety in rural areas at key locations.

Albuquerque, NM: Clearance times for incidents were reduced 44% with the implementation of motorist assistance patrols and a temporary traffic management center during a construction project. Two courtesy patrols and one wrecker were on duty during weekdays, and a police substation was operational at the work zone during A.M. and P.M. peak periods.

Dane County, WI: Portable dynamic message signs are used to notify motorists of construction and maintenance projects and of alternate routes. Power is provided via solar pack or battery.

Idaho: The use of dynamic message signs during periods of high winds and snow covered pavement showed that vehicle speeds dropped 35% to 35 mph when warning messages were displayed, compared to a 9% drop to 44 mph without the dynamic message signs.

# How Does the California ITS Architecture and System Plan Impact Me?

It Affects Everyone

Whether you are a public agency, private corporation, academic institution, or concerned citizen, the California ITS Architecture and System Plan can affect you in different ways. First, it provides for a coordinated and streamlined transportation network, which will enable everyday citizens to travel throughout the state in a more efficient and informed manner. Just as travelers can currently drive on bridges and toll roads in both Northern and Southern California paying with the same transponder, transit users would be able to refer to a single source of information (phone number and/or website) to get real-time information on schedule changes or service announcements as they travel from one region in California to another. There is no need for duplicative systems from a traveler's perspective.

There are also ways that the California ITS Architecture and System Plan may impact the businesses that you deal with. For instance, commercial vehicles would be able to bypass weigh stations and check points or enter ports with a standard transponder technology. By improving the efficiency of goods movement, the ITS architecture can pave the way to lower prices for consumers.

The California ITS Architecture and System Plan impacts the public agencies that are responsible for providing transportation services to California. For example, Caltrans will be able to better manage traffic congestion and incidents across regions and provide critical information to drivers. State, regional and local agencies will be better able to manage incidents and respond to emergencies because of coordinated strategies across jurisdictions. These types of improvements will result in better interregional mobility.
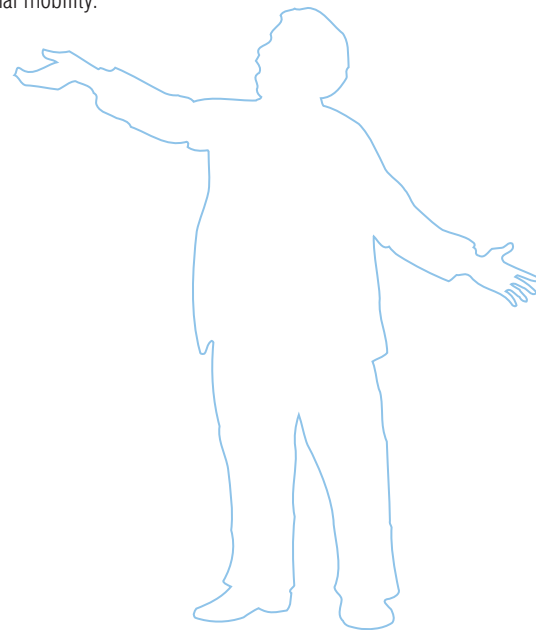
Positive Impact for all Californians

Academic institutions and planning agencies will have better access to information through a connected service that provides access to historic traffic data, enabling better transportation planning and modeling at the state and regional level. Increased research opportunities for universities and non-profit institutions may ultimately lead to newer and better strategies and technologies to further improve the safety and mobility of our transportation network.

Ultimately, the California ITS Architecture and System Plan will have a positive impact on all Californians. Many stakeholders have had input throughout the development process through working groups, steering committees, advisory committees and the project web site. A thorough system engineering process has been followed to develop the California ITS Architecture and System Plan in accordance with federal requirements. The end product is a plan that will enhance interregional and statewide mobility for all users and providers of California's transportation system.

SCENARIO

The bus on Route 361 arrives. Gregory does not even have to remove his smart card from his wallet. The card can be read by a card reader even at a distance of several inches. With all the traveling that Gregory does daily on public transit, he likes the fact that his smart card can be issued by his local agency, yet the smart card works on many participating public transit buses, trains, and shared ride vehicles operated by different local or regional agencies. Whenever he makes a bus transfer to a different transit agency, such as the one coming up in a few minutes, the ease and efficiency of the system becomes extremely apparent. He also likes the fact that the smart card is a pre-paid card, which can be reloaded at major vendors and does not necessarily have to be loaded at a transit store or station.

Consistency and Compliance

Meeting Federal Regulations

An important aspect of the California ITS Architecture and System Plan is that it helps bring the State of California into compliance with federal regulations, keeping California eligible for continued Highway Trust Funds for these technology-based projects. Federal regulations require that Intelligent Transportation System (ITS) projects funded by FHWA and FTA programs conform to the National ITS Architecture and any applicable, adopted ITS communication standards. FHWA has further established a deadline of April 2005 for regions to have ITS architectures in place. The California ITS Architecture and System Plan includes documentation that meets these regulations for state-level projects, such as those related to commercial vehicle safety checks and credentialing, ensuring that we can continue to garner federal support in our endeavors to improve the efficiency of the goods movement vital to our livelihood.

Providing the Framework

Aside from complying with federal policy, the California ITS Architecture and System Plan will also provide California with a framework that encourages and supports integrated services for travelers that are not limited by regional boundaries. For example, when an agency plans to implement an ITS project that they desire to coordinate with other systems already in place, such as a 511 traveler information system, the agency can refer to the architecture to see which communication standards should be considered and which other agencies and systems are in place that the project should look at for coordination. In the case of the 511 system, this would result in a user being able to get Sacramento-area information when calling from the Bay area, for example. Procedures have been outlined to enable the plan to stay up-to-date as new projects are implemented and existing ones are modified.
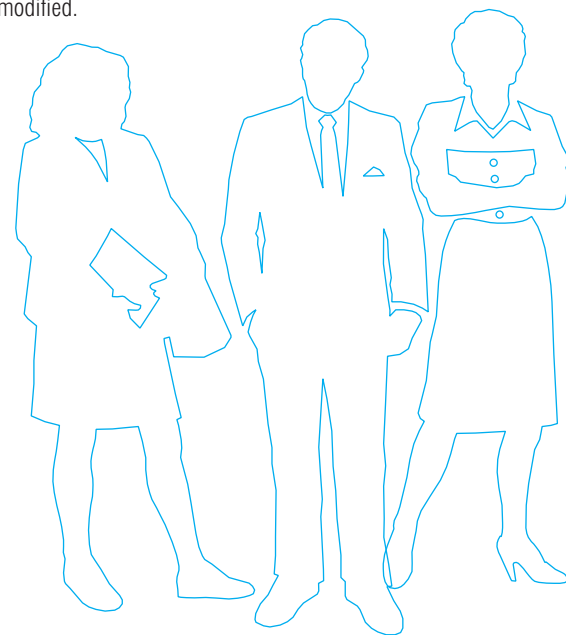
How does the Statewide ITS Architecture relate to the Regional Architectures?

The California ITS Architecture and System Plan utilized existing and developing regional ITS plans and architectures from all over the State (including regional ITS architectures and strategic deployment plans, the statewide Initiatives project, and the Caltrans draft Transportation Management Systems Master Plan) as inputs to develop a framework and baseline for the new California ITS Architecture and System Plan, which focuses on the state-level and interregional systems in the state. In all, over 75 resources were used to develop this plan. Components of regional ITS architectures and plans that were currently under development during the course of this project were included where possible, as progress was made on those parallel efforts. Efforts were made to incorporate these components at appropriate stages of the project.

Another way that the statewide architecture relates to the regional architectures is the reciprocal relationship. As regional architectures are updated in the future, the statewide architecture and plan can provide a starting point and framework for updates that emphasize interregional connectivity…possibly to a greater extent than before.
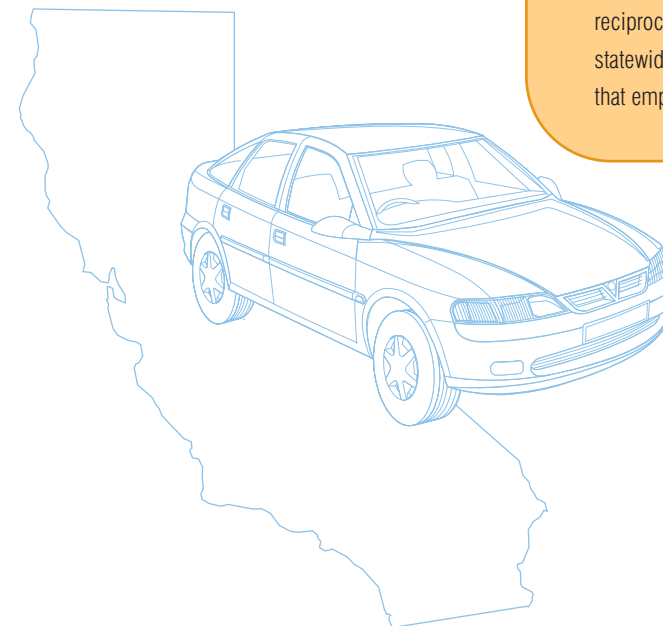
Caltrans' Role

A Plan for all of California

The California Statewide ITS Architecture and System Plan is a plan for California, not just for Caltrans. It lays out a path for improving the way that people travel in this state by using technology to ease congestion on our roads, make transit easier to use, and get real, useful information to drivers as fast as possible. So where does Caltrans fit in?

As the state's department of transportation, Caltrans' responsibilities range from building new roads to supporting intercity passenger rail service in California. Caltrans strives to be the highest performing transportation agency in the country through a commitment to achieving goals related to safety, reliability, performance, flexibility, and productivity of the transportation system. The California ITS Architecture and System Plan provides a roadmap, so to speak, that will guide Caltrans in achieving some of these goals through integrated technology applications.

With a population of over 35 million, and projections that this could grow to over 39 million in just the next six years, the State of California is larger than many countries. It has one of the largest metropolitan areas in the nation, stretching almost contiguously from Los Angeles to the San Diego border with Mexico. Over 22 million licensed drivers and many more who rely on our public transportation services need ways to get around to work, to school and for recreation. That translates to a lot of miles driven on our transportation network and a lot of time spent in our cars, buses, and trains.

Caltrans is organized into 12 districts in order to manage their portion of our transportation network. Districts work with local and regional agencies to better accommodate the varied transportation issues within each section of the state. Headquartered in Sacramento, the state agency has divisions to deal with everything from research and innovation to maintenance.

Caltrans geographic districts and operating divisions have different roles and responsibilities related to technology in our transportation network, but what these facets share is a common goal of implementing the consensus-based architecture and system plan to improve our quality of life.

Primary Components of the Plan

The California ITS Architecture and System Plan includes two primary components:

1. a complete and succinct plan for applying technology to aspects of the transportation network across the state and

2. guidance for connecting or coordinating efforts between and among different regions.

Caltrans has a role in all of this.

From the Division of Transportation Planning in Sacramento, Caltrans led the effort to develop this Statewide Architecture and System Plan and they will continue to keep it up-to-date, revising it over the years to suit changing priorities and fresh ideas.

From the divisions at headquarters to the districts out in the field, Caltrans as a whole will continue to support the implementation of the California ITS Architecture and System Plan. At a district level, operations and maintenance staff will continue to work with regional and local agencies to better coordinate activities, build projects together, and ultimately work toward minimizing the distinction between what Caltrans operates and what cities operate. This is a line that travelers don't want or need to see.
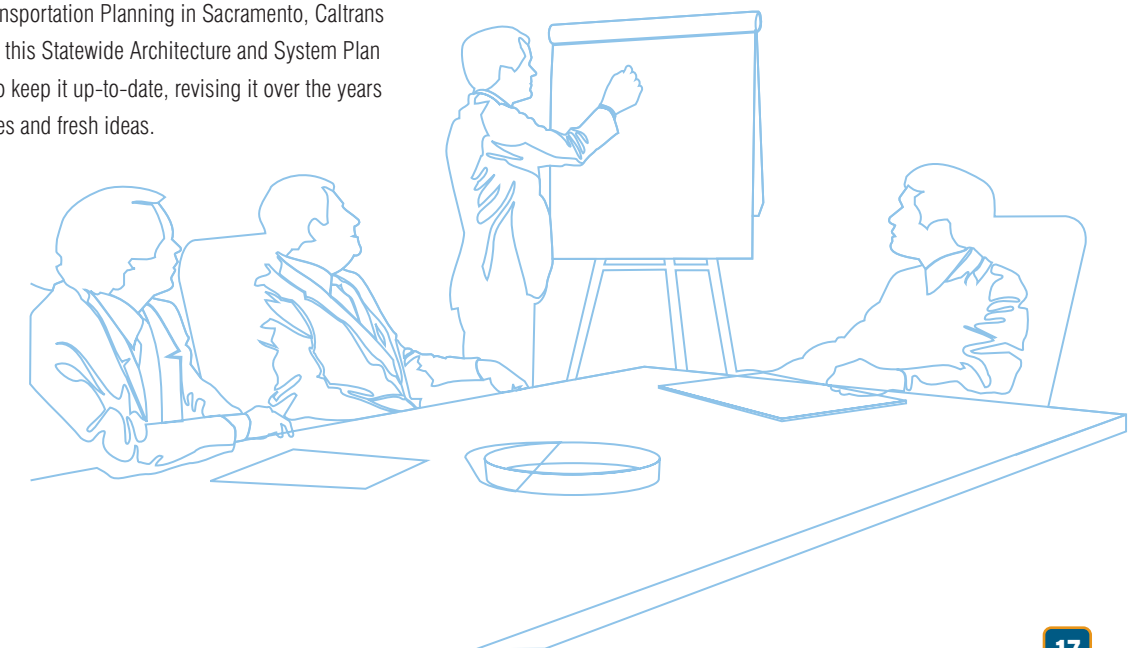
Local and Regional Agencies' Roles

Though the California Statewide ITS Architecture and System Plan does not replace or supersede the regional ITS architectures that have been developed at the regional level in California, local and regional agencies will play a key part in its implementation.

The statewide plan has developed recommendations, based on extensive research and stakeholder input, that can lead to great improvements in our transportation network. Projects that get deployed at a state level will be championed and led by state agencies such as Caltrans, but may involve partnership with regional and local agencies. For example, as Caltrans implements solutions developed in the Department's TMS Master Plan, such as developing coordinated incident response plans and increasing consistency in management systems among Caltrans districts, local and regional agencies will contribute as key partners.

Promoting Interregional Efforts

At a regional level, projects will move forward as shaped by local and regional leaders in various regions. The California Statewide ITS Architecture and System Plan has done the legwork to develop a plan that supports multiple regions pursuing coordinated, interregional efforts. Those projects and services that are funded, built, operated, and maintained by regional and local agencies will remain the responsibility of those agencies and as such, the final determination of whether interregional coordination or integration is valuable and affordable will rest with those agencies.

A key theme of the California ITS Architecture and System Plan is for local and regional agencies to maintain their autonomy and responsibilities over the projects and efforts in their regions within the state.
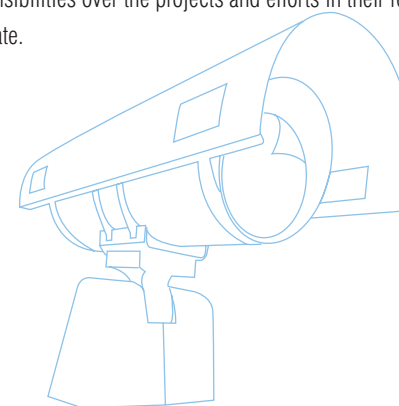
Gregory notices that the bus seems to have been stuck in traffic for some time. But all of a sudden the drive is expedited by all the green traffic signals the bus receives along Fair Oaks Avenue. Luck? No. Most buses are equipped with transit priority capabilities, allowing them to "call" or "hold" green lights when they are nearing intersections if the buses are behind schedule or if the bus load is above a certain number of passengers. There are different ways for transit systems to implement signal priority. In this case, after the Route 361 bus passes the traffic bottleneck, the signal controllers at each intersection along Grant Street know that the bus is running a little late since the controllers constantly "communicate" with the buses through radio signals or through a central dispatch system. Since the intersection signal then "knows" that the bus is running late, the signal controller will hold the green signal allowing the bus to get through that intersection. Other signal priority systems can give buses priority based on the number of passengers on the bus. Passengers can be counted using automatic passenger counters, or by recording the number of smart cards swiped.

What is Contained in the Architecture and Plan?

Though the entire State of California is covered geographically, the plan addresses only state-level services and potential interregional technology-based services and solutions. As such, the plan is comprehensive for state-level services (such as those provided by Caltrans) and addresses potential opportunities for interregional services and integration of systems. From the perspective of regional stakeholders, interregional services should be considered in future project development, but are in no way required to be implemented.

Services are designated as state-level, interregional, local/regional, or private by the following definitions.

▷ **State-level (S)** - Services that are, or will be, delivered on a state-level basis, including services that are delivered regionally by Caltrans and are recommended to be delivered in a standardized manner across the state. These "standardization" recommendations apply only to Caltrans (for example, standardizing the way in which public and private entities access data at each district for traveler information or traffic management uses) with one exception: electronic toll collection is already standardized at a state level based on Title 21, which is an open standard for Automatic Vehicle

Identification (AVI) developed by Caltrans with electronic toll collection as the initial application (State law mandates that electronic toll collection equipment and data formats must comply with Title 21 to ensure interoperability).

▷ **Interregional (I)** - Services that are delivered on a regional basis which have interregional operational implications, including standards for technology deployment, data sharing or interface requirements.

▷ **Local (L)** - Services that are delivered on a local or regional basis that have no interregional implications (these services are addressed by regional ITS architectures and are not further described in this CA Statewide ITS Architecture and System Plan except required interfaces with these services primarily for provision of data).

▷ **Private (P)** - Services that are delivered primarily by the private sector but that have interactions with statewide or interregional public sector services (primarily for provision of data). The California ITS Architecture and System Plan makes provision for connections to private services, but otherwise does not fully map connections between and among private entities.

Connectivity is Key

Given the goal of the architecture and plan to encourage and support connectivity and coordination between services and given the overlap of responsibilities and involvement by various agencies in the delivery of these services, many of the categories have more than one designation. For example, some transit agencies serve solely local customers, while others traverse regional boundaries. As such, electronic fare payment services for transit systems is both local and interregional.
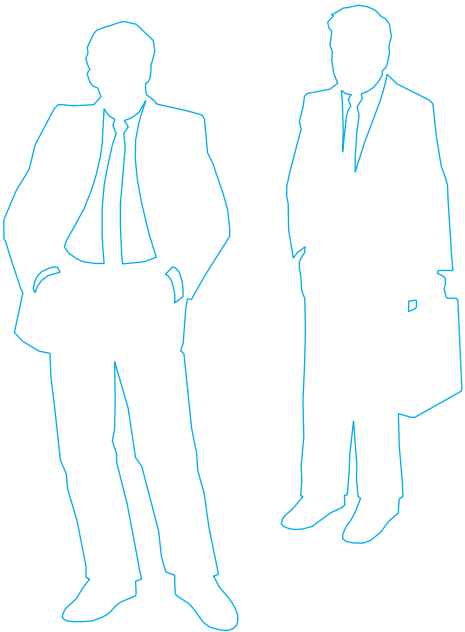
State-Level Services

▷ **Pre-Trip Travel Information**
▷ **En-Route Driver Information**
▷ **Traffic Control**
▷ **Incident Management**
▷ **Public Transportation Management**
▷ **Electronic Payment Services (also an interregional service)**
▷ **Commercial Vehicle Electronic Clearance**
▷ **Automated Roadside Safety Inspection**
▷ **On-Board Safety and Security Monitoring**
▷ **Commercial Vehicle Administrative Processes**
▷ **Hazardous Material Security and Incident Response (also an interregional service)**
▷ **Emergency Notification and Personal Security**
▷ **Emergency Vehicle Management (also an interregional service)**
▷ **Disaster Response and Evacuation (also an interregional service)**
▷ **Archived Data (for state agency data)**
▷ **Maintenance and Construction Management (for state agencies)**

Interregional Services

▷ **Pre-Trip Travel Information**
▷ **En-Route Driver Information**
▷ **Traffic Control**
▷ **Incident Management**
▷ **Public Transportation Management**
▷ **En-Route Transit Information**
▷ **Electronic Payment Services (also a statewide service)**
▷ **Hazardous Material Security and Incident Response (also a statewide service)**
▷ **Emergency Vehicle Management (also a statewide service)**
▷ **Disaster Response and Evacuation (also a statewide service)**
▷ **Archived Data (for local and regional data)**
▷ **Maintenance and Construction Operations (for local and regional agencies)**

How to Use the Statewide Architecture and System Plan

The statewide architecture can be used in several ways by regional and local agencies, by private organizations, and by various personnel at Caltrans and other state agencies. Several specific examples are included here:

To guide planning, deployment, and operational decisions. The architecture provides an overall framework and vision to assist in prioritization, funding and selecting projects and efforts to move forward at any level in the state. This summary document or the Introduction, Desired Outcomes, and Project Sequencing sections of the final report might be especially useful as references for this purpose.

To support project deployment. Sections of the architecture, especially the functional requirements and operational concept can be used as is or revised as appropriate in the initial steps of the systems engineering process, which is a step-by-step project definition, development, and testing process required to be used by federal regulation. Using what has been developed in these sections may save time and effort in getting started in project definition and documentation as a part of this process.

As input to what might be included in regional ITS architectures. The statewide architecture can provide a strong starting point for regional architecture updates by providing ideas for interregional services that may be beneficial to include in the regional plan. Using the statewide architecture as a starting point for discussions can save a lot of research effort about what services the region should consider coordinating. A summary list of interregional services that are suggested for consideration are listed on page 21. More detail about these services can be found in the final report and associated technical appendices. One region in California is using the entire detailed architecture (from the basic inventory to the specific information flows) as a starting point to develop a revised regional architecture for that region.

As input to what could be omitted in regional ITS architectures. The statewide architecture addresses categories such as goods movement that are managed by state agencies. As such, many architectures that have been drafted or updated recently have referenced the statewide architecture to address these types of issues that then do not need to be referenced or planned into the regional architectures.

"The project has effectively addressed those efforts, like goods movement, that are appropriate to be addressed at a state level and has achieved all technical objectives set for it. The project is enabling coordination among regions and not prescribing additional regulations."

–Bob Huddy,
Senior Transportation Planner,
Regional Highway and ITS Planning
Southern California Association of Governments

SCENARIO

Gregory estimates that his transfer bus stop should be coming up in a few minutes. "I wonder if my second bus is on time?" he asks himself. Then he remembers, "I'm sure I would have received a Transit Alert on my PDA if there was a long delay on the other route." At the next stop, Gregory gets off the bus and goes to his next bus stop across the intersection. He knows that neighboring transit agencies usually coordinate schedules at major transfer points such as this one. This way, transfer times are minimized across the entire transit system, and if the first bus happens to be a few minutes delayed, the second bus will usually wait until the first bus arrives so the transfer can still be made.

What Happens Next?

Identify Early Winner Projects

Now that the California ITS Architecture and System Plan is complete, it is up to the stakeholders to ensure that the Plan gets implemented. One of the important next steps will be for the Advisory Committee to review the list of recommended services and identify some early winner projects that can be easily implemented and will have immediate benefits. These candidate projects should already have funding in place or the ability to get funding. The Advisory Committee should assign a champion to each of these early winner projects to facilitate the project's implementation. For example, a project that is statewide in nature such as a Traveler Information System that connects state-level and regional systems (to provide access to users from a single portal, such as a web site address or 511 phone number) might warrant a person from Caltrans taking the lead.

Mainstreaming ITS

Another important next step will be to begin mainstreaming ITS into the planning process. This will be a critical step to get these projects funded since there is a limited amount of funding through federal ITS earmarks. One of the best ways for agencies to fund ITS projects is to incorporate them in elements of other highway projects. As transportation agencies in California are going through their typical planning process to program projects, the decision makers need to consider the services recommended in the California ITS Architecture and System Plan as they identify transportation solutions. It will also be important for the agencies to ensure that as the projects are being developed, they are checked for consistency with the California ITS Architecture and are in compliance with the Final Rule.

Many of the interregional and statewide projects in the plan result in systems and interfaces that will require inter-agency agreements, both public and private, to facilitate the exchange of information. These agreements might document the responsibilities for funding the project or its ongoing operation, identify which agency(ies) will perform routine maintenance, or spell out agreed-to operational procedures that multiple agencies will adhere to. As ITS services and systems are implemented in California, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Updating the Plan

To keep the California Statewide ITS Architecture and System Plan a usable, up-to-date guide that represents the current vision and consensus of affected stakeholders, a Policy Committee will convene. This Policy Committee will consist of representatives from regional agencies throughout the state as well as Caltrans staff. The Committee's primary charge is to coordinate and approve any future changes to the Statewide ITS Architecture and System Plan as we move forward into the future.

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Architecture & System Plan